VEGETATIVE STRUCTURE OF MESOGLOIA.

BY A. C. LIFE.

As very little work has been done upon the vegetative structure of *Mesogloia divaricata*, it seemed an inviting field for investigation, and accordingly work was begun upon it at Wood's Hole, Mass., at the Biological Station, in the summer of 1904.

This work has been continued in the Shaw School of Botany of Washington University.

Previous work has been done mainly by Reinke and Henckel. Reinke*, in 1881, worked out some points of the structure of what he called *Chordaria divaricata*, which Farlow† states is the *Mesogloia* of the New England coast. Engler and Prantl ‡ describe the genus *Mesogloia*, but are not definite in the description of its structure.

Henckel § in 1903 published an account of both *Chordaria flagelliformis* and *C. divaricata* in connection with *Cystoclonium*. His conclusions are different from those of Reinke, concerning the method of growth.

The *Mesogloia divaricata* which was studied in this work was collected at Wood's Hole, Mass., during the early part of August, 1904. It was obtained from water one to two feet in depth at low tide, where it grew attached to rocks and the silty bottom.

The material was fixed in a weak chromo-acetic acid solution in sea water. It was allowed to remain in the

* J. Reinke, Atlas deutscher Meeresalgen. **2**: 57. *pl. 39*. (1889).

† Marine algae of New England. (Report U. S. Fish Commission. **1879**: 84.)

‡ Die Natürlichen Pflanzen-Familien. Teil I. Abteilung 2. p. 229.

§ Sur l'anatomie et la biologie des algues marines. (Scripta Botanica Hort. Universit. Imp. Petropol. **20**: 81.) 1903.

fixing fluid about 15 minutes and then washed in sea water. The grades of alcohol used in dehydrating were mixed with sea water. Sections were made by imbedding in paraffin and cutting with the microtome.

The first preparations were stained with Flemming's safranin-gentian-violet-orange stain. This stain did not prove very satisfactory, as it overstained the cell walls. Later in the work Haidenhain's iron-alum haematoxylin method was used with good results.

In the study of the apex both longitudinal and cross sections were made and mounts were also prepared by crushing in glycerin under the cover-glass. The growing point of *Mesogloia divaricata* so commonly turns to one or the other side of the line of the axis of the stem, as to making it a little difficult to get sections parallel to the axis in this region.

The apex of the stem consists of a central axial row of cells terminating in an apical cell, surrounded by a sheath of cortical cells except at its very tip (plate 38, f. 1). From these cortical cells arise hairs and paraphyses, the "Assimilationsfäden" of Reinke. Further from the tip there may be two or more layers of cells in the cortical sheath (figures 3, 4). In still older parts of the stem there is a central cylinder consisting of the central row of cells with two or more layers of thick-walled cells surrounding it. As mentioned by Henckel,* these are cells that have been cortical cells in the younger stem. Bounding the central cylinder near the apex is a zone of thin-walled cortical cells from which the paraphyses and hairs arise (figures 4, 5).

The contents of the central cells soon begin to break down. The nucleus first degenerates, then the protoplasm becomes grouped here and there in small masses. Soon the cross-walls break down and the contents of the central

* *Loc. cit.*

tube thus formed become granular, and do not stain readily, being probably mucilaginous in nature.

Frequently the interior of the central cylinder has a growth of hyphae and short club-shaped branches resembling paraphyses, from its inner surface.

The branches in the material that I studied had their origin in the cortical cells immediately surrounding the central row of cells. The branching, as shown by the accompanying figures (2, 7), in each case is from the cells adjoining the central row of cells but not from those cells.

Reinke's* account of the method of growth of *Chordaria*, including *C. divaricata*, according to Henckel, has not been verified by any observer since. He claims that the growth is intercalary and extends over the tip of the stem at the basal segments of the paraphyses which stud the tip. However, in point of structure, his figures and account are verified by my sections except that the apex of the central filament does not end in a globular cell as he shows in his figures†. Henckel states that the growth proceeds from a single terminal cell which cuts off lateral cells parallel to the axis of the stem. He shows a similarity of growth to that of *Dictyosiphon* as described by Murbeck. From my own observations, I infer that the growth in length depends upon the lengthening of the central row of cells, which proceeds in a twofold manner. One is real growth of the apex of the central row of cells from an apical cell. The other is increase in length of the central cells by stretching. This stretching is at least partially, if not wholly, caused by the growth of the cortical cells which proceeds both upward and downward from its point of origin from the lateral cells cut off from the central row of cells. Growth in thickness originates by the cutting off of the cortical cells from cells

* Algenflora der westlichen Ostsee, deutschen Antheils. (Bericht der Kom. zur Untersuch. der Deutschen Meere in Kiel. **17-19**[1] : 67. (1889).

† *Loc. cit.*

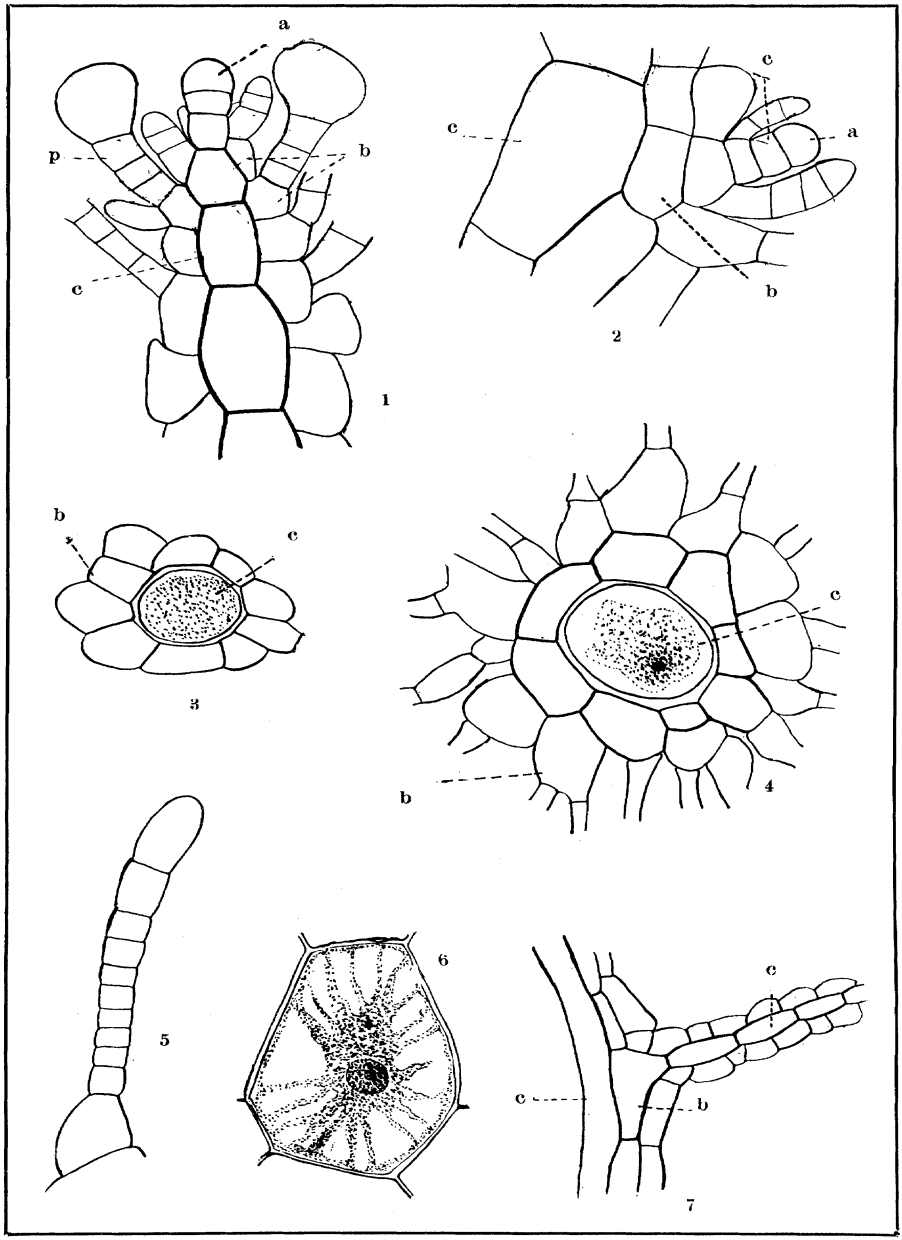
of the central row (figure 1). The further growth of cortical cells to several layers in thickness has not been sufficiently studied to make clear the method of growth. In treating of *Desmarestia*, Jönsson* states that the divisions of the cortical cells are radial and that the outer cells only divide. As the structure of *Mesogloia* is quite similar to that of *Desmarestia* as described by Jönsson, it seems plausible that the same division may occur here.

The above investigation was suggested by Dr. Bradley M. Davis of the University of Chicago, to whom I am indebted for several valuable suggestions.

EXPLANATION OF PLATE.

Plate 38. — 1, Median longitudinal section of the apex of the stem of *Mesogloia divaricata: a*, apical cell; *b*, cortical cell; *c*, central filament; *d*, paraphysis, × 600. 2, Longitudinal section of stem near apex, through primordia of a branch: lettering the same as in figure 1, × 600. 3, Cross section of stem just back of apex, showing cortical cells, × 600. 4, Cross section of stem further from apex, showing thickening of the walls of the cortical cells to form the central cylinder, × 600. 5, Hair, nearly mature, × 600. 6, Cell from the central row, near the apex, × 720. 7, Origin of branch from cell adjoining central row of cells: a later stage than that shown in figure 2, × 360.

* Kentniss des Baues und der Entwicklung des Thallus bei den Desmarestiaeen. (Lunds Universitets Aarskrift. **37.** Afd. 2. No. 6.)



MESOGLOIA DIVARICATA.